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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/146,839 09/03/98 SRINIVASAN

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EXAMINER

021567 MM91/1121
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ART UNIT

PAPER NUMBER

2814

DATE MAILED:

11/21/00

Please find below and/or attached an Office communication concerning this application r
pr ceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/146,839

Applicant(s)

SRINIVASAN ET AL.

Examiner

Anh D. Mai

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☒ Responsive to communication(s) filed on 29 August 2000.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-8,10,13-20,22-28,36,38 and 39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4-8,10,13-20,22-28,36,38 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) _____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1, 4-7, 10, 13-17, 22-28 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf (U.S. Patent No. 5,849,644) in view of Kirchhoff et al. (U.S. Patent No. 6,057,250).

Schuegraf teaches a method of forming a fluorine doped insulating material similar as claimed including:

providing a substrate (24) within a reaction chamber, the reaction chamber controlled within a range of temperatures from above 400 °C;

providing reactants comprising silicon, fluorine and oxygen within the reaction chamber;
and

depositing an insulating material, at a rate of from about 1000 Å/min to about 10,000 Å/min, comprising fluorine, silicon and oxygen onto the substrate from the reactants, wherein the depositing occurs with a plasma being present in the reaction chamber. (See col. 3, l. 1-col. 5, l. 55).

Thus Schuegraf is shown to teach all of the features of the claim with the exception of using ozone as one of the reactant gas.

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However, Kirchhoff '250 teaches using ozone as an oxygen source for the reactant gas. (See col. 5, ll. 24-37).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to use ozone source gas as a reactant gas in place of the oxygen source gas of Schuegraf as taught by Kirchhoff because ozone is well known in the art to be used as a reactant gas since the decomposition rate of ozone is faster than other oxygen source such as H₂O.

Regarding the limitation of the insulating material comprising fluorine, silicon and oxygen, since FTES can be used as a precursor in place of TEOS, thus the resulting insulating material of Schuegraf should obviously contain fluorine.

Given teaching of the references, it would have been obvious to one having ordinary skill in the art to determine the optimum deposition temperature of the insulating material. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

With respect to claims 4-6, the precursor of Schuegraf includes FTES, thus silicon and fluorine are comprised within a common molecule.

With respect to claim 7, since FTES is used as a precursor thus, the resulting insulating material should obviously contain an Si-F bonds.

With respect to claim 10, the pressure within the reaction chamber of Schuegraf is within the claimed range.

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With respect to claim 13, the reactants of Kirchhoff further comprise phosphorous thus result in a insulating material comprises fluorine, silicon, oxygen and phosphorous.

With respect to claim 14, the reactants of Kirchhoff further comprise boron thus result in a insulating material comprises fluorine, silicon, oxygen and boron.

With respect to claim 15, the reactants of Kirchhoff further comprise boron and phosphorous thus result in a insulating material comprises fluorine, silicon, oxygen, boron and phosphorous.

With respect to claims 16 and 17, the reactants of Kirchhoff comprise a molecule that includes both Si and F (FTES), and another molecule that includes Si without F (TEOS).

With respect to claim 22, the boron-containing precursor of Kirchhoff is TEB.

With respect to claim 23, in view of Kirchhoff the reactants further comprises a phosphorous-containing precursor, thus the insulating material deposited is a phosphorous-doped silicon oxide having Si-F bonds.

With respect to claim 24, the phosphorous-containing precursor of Kirchhoff is TEPO.

With respect to claim 25, the reactants of Kirchhoff further comprises a phosphorous-containing precursor, a phosphorous-containing precursor, thus the insulating material deposited is a boron and phosphorous-doped silicon oxide having Si-F bonds.

With respect to claim 26, the boron-containing precursor of Kirchhoff is triethyl TEB.

With respect to claim 27, the phosphorous-containing precursor of Kirchhoff is TEPO.

With respect to claim 28, the phosphorous-containing precursor of Kirchhoff is TEPO and the boron-containing precursor of Kirchhoff is TEB.

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With respect to claim 36, the insulating material of Schuegraf has a deposition rate of about 7,000 Å per minute thus can be seen as similar to about 8,000 Å since no criticality is established.

Further, it would have been obvious to determine the optimum deposition rate of the insulating material. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

2. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 and Kirchhoff '250, as applied to claim 1 above, and further in view of Homma (U.S. Patent No. 5,288,518).

Schuegraf and Kirchhoff are shown to teach all of the features of the atomic percentage of fluorine in the insulating material.

However, Homma '518 teaches the atomic percentage of fluorine in the fluorine-containing silicon oxide film is within the claimed range. Further, no criticality has been established.

3. Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 in view of Kirchhoff '250.

Schuegraf teaches a method of forming a silicon oxide having Si-F bonds similar as claimed including:

providing a reaction chamber at a of temperatures in excess of 400 °C;

position a substrate (24) within the reaction chamber;

providing a precursor having Si-F bonds to the substrate within the reaction chamber; and causing a silicon oxide having Si-F bonds, to deposit onto the substrate within the reaction chamber at a rate of from about 1,000 Å/min to about 10,000 Å/minute. (See col. 3, l. 1-col. 5, l. 55).

Thus, Schuegraf is shown to teach all of the features of the claim with the exception of providing an ozone comprising reactant.

However, Kirchhoff '250 teaches providing an ozone comprising reactant in a reaction chamber to form a silicon oxide having Si-F bonds. (See col. 5, ll. 7-23).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to use ozone reactant gas in place of the oxygen source gas of Schuegraf as taught by Kirchhoff because ozone is well known in the art to be used as a reactant gas since the decomposition rate of ozone is faster than other oxygen source such as H₂O.

Regarding the limitation of the silicon oxide having Si-F bonds, since FTES can be used as a precursor in place of TEOS, thus the resulting insulating material of Schuegraf should be silicon oxide having Si-F bonds.

Further, given teaching of the references, it would have been obvious to one having ordinary skill in the art to determine the optimum deposition temperature of the insulating material. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

With respect to claim 19, the precursor of Schuegraf is FTES, thus having Si-F bonds.

With respect to claim 20, the deposition of Schuegraf is with plasma.

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4. Claims 38 and 39 rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 and Kirchhoff '250, as applied to claim 18 above, and further in view of Vassiliev (U.S. Patent No. 5,876,798).

Schuegraf and Kirchhoff are shown to teach all of the features of the claim with the exception of maintaining the reaction chamber at a higher pressure.

However, Vassiliev, teaches maintaining the reaction chamber at a pressure of 10 to 760 Torr to form a satisfactory film. (See col. 5, ll. 5-7).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to maintain the reaction chamber of Schuegraf at the pressure as taught by Vassiliev to form a satisfactory insulating film.

Regarding the process temperature *in excess of 500 °C but less than 630 °C*, the hot wall system of Schuegraf '644 operates *around 640 °C*. The term *around 640 °C* of Schuegraf '644 includes above and below 640 °C. The temperature range is not critical since there is no unexpected result occurred. Given teaching of the references, it would have been obvious to one having ordinary skill in the art to determine the optimum deposition temperature of the insulating material. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

Response to Arguments

5. Applicant's arguments filed August 29, 2000 have been fully considered but they are not persuasive.

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Contrary to Applicant argument that Schuegraf '644 fails to teach the temperature limitation of claim 1, the term "around 400 °C" clearly encompasses the limitation of "above 400 °C".

Applicant's assertion: Schuegraf '644 *impliedly teaches against extending the temperature of the plasma process above 400 °C* is erroneous.

First of all, Schuegraf '644 teaches: "around 400 °C". The term "around 400 °C" denotes a temperature range that includes "*above or below 400 °C*".

Secondly, Schuegraf '644 also teaches: "Preferably, CVD system 16 are low pressure chemical vapor deposition (I.PCVD) *hot wall systems*, although other CVD systems, such as *cold wall systems* can be used as will become apparent". (col. 3, ll. 44-47).

Schuegraf '644 and Kirchhoff '250 teaches all limitations of claim 1 and claims 4-7, 10, 13-17, 22-38 and 36.

With respect to claims 8 and 18-20, the temperature range has been discussed above.

6. Applicant's arguments with respect to claims 18-20, 38 and 39 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
November 14, 2000


OLIK CHAUDHURI
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